Appl. No. 10/719,046
Supplement to Amendment
dated August 15, 2005

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Amend claims 1-3, 5, 9 -11 and 14 as shown below:

1. (currently amended) A deep hardening Cu/Ni/Cr alloy steel for reducing the cost of high toughness, high strength steels, by eliminating the use of the scarce high cost alloying elements cobalt ~~, nickel~~ and molybdenum comprising by weight: about 0.40-1.0% copper; about 0.80-3.5% of chromium; about 2.5-8.0% nickel; about 0.55-1.50% of silicon; about 0.15-1.50% manganese; at least one of the transitional elements, vanadium in about 0.10-1.00% by weight and titanium in about 0.10-0.65% by weight; and the remainder iron, carbon and incidental impurities.

2. (currently amended) A deep hardening Cu/Ni/Cr alloy steel for reducing the cost of high toughness, high strength steels by eliminating the use of ~~use of~~ the scarce high cost alloying elements cobalt ~~, nickel~~ and molybdenum comprising about 0.40-0.65% by weight of copper; about 0.75-1.50% by weight of silicon, said copper and said silicon being present in a Si to Cu weight ratio of about 1.2-2.5%; about 1.50-3.50% by

weight of chromium; about 1.0 -6.0% by weight of nickel; about 0.35-0.50% by weight of carbon before and after deep hardening; about 0.50 -1.50% by weight of manganese; at least one of the transitional elements, vanadium in about 0.10-1.00% by weight and titanium in about 0.10 -0.65% by weight; and the remainder iron and incidental impurities.

3. (currently amended) A deep hardening Cu/Ni/Cr alloy steel for reducing the cost of high toughness, high strength steels by eliminating the use of ~~use of~~ the scarce high cost alloying elements cobalt ~~, nickel~~ and molybdenum comprising by weight about 0.4 to 1.0% Cu, about 2.5 to 8.0% of Ni, about 0.8 to 3.5% Cr, about 0.50 to 1.5% Si, at least one of the transitional elements, vanadium in about 0.10-1.00% by weight and titanium in about 0.10 - 0.65% by weight and characterized by the presence of retained austenite after quenching from an austenitizing temperature, said steel having a microstructure comprised of a major phase of lath martensite enveloped by a minor phase of retained austenite.

4. (previously presented) The steel recited in claim 3 wherein said medium carbon Cu/Ni/Cr steel comprises by weight about 0.35 to 0.50% C and about 0.50-1.50% Mn.

5. (currently amended) A low cost rolled or forged article <u>of</u> high toughness, high

strength Cu/Ni/Cr alloy deep hardening steel having after quenching and tempering an HRC hardness of at least 50, a yield strength of at least 200 ksi and an impact strength value KcV of at least 28 ft-lb, and consisting essentially of by weight: about 0.50-0.70% of copper; about 0.80-3.50% of chromium; about 2.0 - 8.0% nickel; about 0.35-0.50% carbon; about 0.75-1.50% silicon; about 0.65-1.20% manganese; at least one transitional element; and the remainder iron and incidental impurities.

6. (original) The article recited in claim 5 wherein said transitional element by weight is about 0.10-1.00% vanadium.

7. (original) The article recited in claim 5 wherein said transitional element by weight is about 0.10 - 0.65% titanium.

8. (previously presented) A low cost, high toughness, high strength deep hardening Cu/Ni/Cr alloy steel consisting by weight essentially of: 0.22-0.32% carbon, less than .65% copper; about 0.80-1.5% of chromium; about 1.0- 3.5% nickel; about 0.50 -1.00% silicon; about 0.50 -1.00% manganese; at least one from a group of transitional elements: about 0.10-0.50% of vanadium, 0.10-0.35% titanium; and the remainder iron and

incidental impurities including less than 0.45% sulfur and less than 0.25% phosphorous, and having high core strength and toughness after carburizing.

9. (currently amended) An article manufactured from a low cost, high toughness, high strength Cu/Ni/Cr alloy steel without the scarce high cost alloying elements cobalt ~~, nickel~~ and molybdenum consisting by weight essentially of: about 0.32-0.55% carbon, about 0.50-1.00% of silicon; about 0.40-1.0% copper; about 0.80-3.5% of chromium; about 1.0-3.5% nickel; about 0.50 -1.00% manganese; at least one from a the group of elements: 0.10-1.0% of vanadium, 0.10-0.65% titanium; and the remainder iron and incidental impurities and having after nitriding an exceptionally deep and hard outer case and high core strength and toughness.

10. (currently amended) A rolled or forged article made from a low cost high toughness, high strength, Cu/Ni/Cr deep hardening alloy steel without the scarce high cost alloying elements cobalt ~~, nickel~~ and molybdenum consisting essentially by weight of about 0.4 to 1.0% Cu, about 2.0 to 8.0% of Ni, about 0.8 to 3.5% Cr, about 0.50 to 1.5% Si, at least one from a group of transitional elements: about 0.10 -1.0% of vanadium, 0.10-0.65% titanium, the remainder iron and incidental impurities and characterized by the

presence of retained austenite after quenching from an austenitizing temperature, said steel having a microstructure comprised of a major phase of lath martensite enveloped by a minor phase of retained austenite and a hardness of at least HRC 50, a yield strength of at least about 200 ksi and a Charpy impact value ~~KeV~~ KCV of about at least 28 ft-lb.

11. (currently amended) A method for producing a low cost, high toughness, high strength Cu/Ni/Cr alloy steel with an HRC hardness of at least 50, a yield strength of at least 200 ksi and an impact strength value ~~KeV~~ KCV of at least 28 ft-lb without the scarce high cost alloying elements cobalt ~~, nickel~~ and molybdenum consisting essentially of the steps of: adding to molten iron, by weight 0.4-1.0% copper and 0.50 -1.5% silicon wherein the ratio of Si to Cu is within a range of ~~1.0~~ 1.2 -2.5%; selecting desired levels of yield strength and toughness; adding an amount of Ni within a range of about 1.0 to 8.0% for meeting said desired levels of yield strength and toughness; selecting desired levels of hardness and ultimate strength; adding in said molten state an amount of carbon within a range by weight of about 0.22 to 0.55% for meeting said selected levels of hardness and ultimate strength; adding in said molten state by weight about 0.10-1.0% vanadium or about 0.10-0.65% titanium; casting and forming said steel; quenching said steel from an austenitizing temperature to form a microstructure having a major phase of lath martensite

enveloped by a minor phase of retained austenite.

12. (original) The method recited in claim 11 further comprising the step of adding in said molten state by weight about 0.10-1.0% vanadium.

13. (original) The method recited in claim 11 further comprising the step of adding in said molten state by weight about 0.10 - 0.65% titanium.

14. (currently amended) The method recited in claim 11, wherein ~~said medium carbon Fe/Cr/C/Mn~~ alloy steel comprises by weight about 0.8 to 3.5% Cr and about 0.65 to 1.2% Mn.